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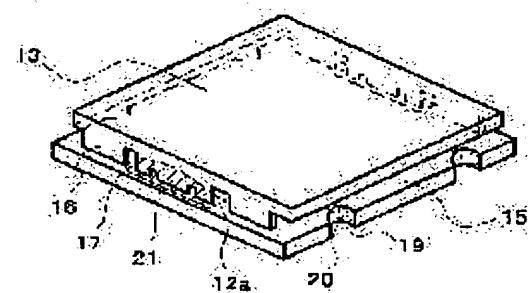
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(54) SURFACE-MOUNTING CRYSTAL OSCILLATOR

(57) Abstract:

PROBLEM TO BE SOLVED: To provide a surface-mounting crystal oscillator that is flat and has a small volume by thinning the thickness of an insulating substrate as compared with the conventional one.

SOLUTION: The crystal oscillator comprises the flat insulating substrate 15, a packaging electrode formed on the lower surface, a conductive pattern 12d of an oscillation circuit formed on the upper surface of the insulating substrate 15, electronic components for composing a crystal oscillation circuit that is packaged on a conductive pattern 12a, and a metal lid 13 that covers the electronic components with the insulating substrate 15 for joining the lower end to conductive pattern 12a electromechanically. The lid 13 is obtained by performing the press forming of a thin metal plate in a box shape whose bottom surface is open, has a pair of extended sections 16 that oppose each other from the lower end, and joints the lower end of the extended sections 16 to the conductive pattern 12a on the insulating substrate 15. By joining the lid 13 onto the upper surface of the insulating



substrate 15, the thickness of the insulating substrate 15 can be extremely thinned as compared with before.

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CLAIMS**[Claim(s)]**

[Claim 1] The crystal oscillator of the surface mount mold characterized by to cover the top face of the above-mentioned insulating substrate from on an insulating substrate, the mounting electrode formed in the inferior surface of tongue of the above-mentioned insulating substrate, the electric-conduction pattern of the oscillator circuit formed in the top face of the above-mentioned insulating substrate, the electronic parts which are mounted in the above-mentioned electric-conduction pattern, and constitute a ridge oscillator, and the above-mentioned electronic parts, and to provide a machine and the metal lid joined electrically to the above-mentioned electric-conduction pattern for the lower-limit section.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] Especially this invention relates to the crystal oscillator of the surface mount mold which made height low and made the volume small in a crystal oscillator.

[0002]

[Description of the Prior Art] Recently, corresponding to small and lightweight-izing of mobile transmitters, such as a cellular phone, the electronic parts of various surface mount molds are developed. Since the electronic parts of a surface mount mold carry and mount a lead terminal on a substrate like the former unlike the type inserted in the hole drilled in the substrate, they have the advantage to which small and thin shape-ization progress. A surface mount mold which also formed the crystal oscillator into the Lee dress with the thin shape is desired.

[0003] Drawing 4 and drawing 5 are drawings explaining the crystal oscillator of the conventional surface mount mold. In addition, drawing 4 is the assembly perspective view of the crystal oscillator of a surface mount mold, and a perspective view in the condition that drawing 5 was completed. The crystal oscillator of a surface mount mold put the metallic lid 2 on the insulating substrate 1 which mounted the electronic parts 3, such as a circuit element and a quartz resonator, and is joined to it.

[0004] An insulating substrate 1 is tabular, for example, consists of insulating materials, such as a glass epoxy resin and a ceramic, forms the electric conduction pattern (not shown) of an oscillator circuit in a top face, and forms the mounting electrode (not shown) in an inferior surface of tongue. Moreover, form two or more notching 5 in a side face, electric conduction material, such as copper, is made to adhere to the wall surface of each notching by the so-called plating processing, and the connection electrode 6 is formed. The mounting electrode of the predetermined part of the electric conduction pattern of the top face of the above-mentioned insulating substrate 1 and an inferior surface of tongue is electrically connected through the connection electrode 6.

[0005] The lid 2 is carrying out press forming of the thin metal plate to the cube type which the base opened, and forms the extension section 7 downward comparatively shorter than each lower limit edge, the 1st comparatively long joint 8, and comparatively long joint 8 of ** 2nd a. If a lid 2 is put from an insulating substrate 1, the tip of the extension section 7 of a lid 2 is fixed on the top face of an insulating substrate 1, and the 1st joint 8 will join to the notching 5 to which the side face of an insulating substrate 1 corresponds, and it will flow through it electrically with the connection electrode 6 in notching.

[0006] Moreover, 2nd joint 8a carries out bulge processing of the tip side to the inner direction, and forms the bulge section 9. The bulge section 9 is elastically inserted in the crevice 10 of notching 5a where an insulating substrate 1 corresponds, and solders to this part by giving the solder 11 of

optimum dose from a side face. Moreover, in order to heighten the junction effectiveness of soldering, he drills a through tube 4 in the 2nd joint 8a at the both-ends side of the extension direction, and is trying to be filled up with solder in the case of soldering.

[0007] However, in order to insert in a lid 2 elastically on the side face of an insulating substrate 1, a certain amount of (it is about 0.8mm conventionally) thickness was required for the insulating substrate 1, and since it corresponded to the above-mentioned thin shape-ization, when thickness of an insulating substrate was made thinner than before, the lid 2 was inserted in on the side face of an insulating substrate 1, and the activity which solders became remarkably difficult and had the problem from which a desired mechanical strength is not obtained, either.

[0008]

[Problem(s) to be Solved by the Invention] This invention was made in view of the above point, is performing junction of an insulating substrate and a lid on the top face of an insulating substrate, if the thickness of an insulating substrate is needed although a lid's is joined on the side face of an insulating substrate therefore, and ** thickness of an insulating substrate, and height aims at offering the crystal oscillator of a low surface mount mold with the small volume.

[0009]

[Means for Solving the Problem] This invention is characterized by to provide the mounting electrode formed in the tabular insulating substrate and the inferior surface of tongue of the above-mentioned insulating substrate, the electric-conduction pattern of the oscillator circuit formed in the top face of the above-mentioned insulating substrate, the electronic parts which are mounted in the above-mentioned electric conduction pattern, and constitute a ridge oscillator, and the metal lid which covered the above-mentioned insulating substrate from on the above-mentioned electronic parts, and joined the lower limit section to the above-mentioned electric conduction pattern electrically mechanically.

[0010]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained to a detail with reference to drawing 1 thru/or drawing 3. The perspective view of the crystal oscillator of the surface mount mold according [drawing 1] to this invention and drawing 2 are these insulating-substrate Figs., drawing (a) is a plan and drawing (b) is a bottom view. Moreover, drawing 3 is this important section enlarged drawing. The crystal oscillator of a surface mount mold is equipped with the tabular insulating substrate 15, the mounting electrode 14, the electric conduction pattern 12, the electronic parts that are not illustrated, and a lid 13.

[0011] An insulating substrate 15 is a board it becomes same from insulating materials, such as a ceramic, mentioning above, and forms the electric conduction pattern 12 for oscillator circuits in a top face. The electric conduction pattern 12 and the mounting electrode 14 formed in the inferior surface of tongue of an insulating substrate 15 are electrically connected through the connection electrode 20 formed in the wall surface of two or more notching 19 prepared in the side face of an insulating substrate 15 like the above-mentioned. Moreover, electronic parts which were mounted in the electric conduction pattern 12 and which are not illustrated, such as a circuit element and a quartz resonator, constitute the ridge oscillator.

[0012] Press forming of the lid 13 has been carried out to the cube type with which the base opened the thin metal plate like the conventional example, and it met from the lower limit edge and has extended the extension section 16 of a pair by the same die length as this direction. A lid 13 is laid in an insulating substrate 15, and it joins to electric conduction pattern 12a in which the lower limit of the extension section 16 was formed on the top face of an insulating substrate 15. By soldering to a part for this joint by giving solder 21, a lid 13 and electric conduction pattern 12a are joined

electrically and mechanically.

[0013] Moreover, by cutting the slot 17 deeply to two places of the extension section 16, in the case of soldering, solder 21 can be given only to the central part pinched by the slot 17, and the useless breadth of solder can be prevented. Furthermore, in order for the solder of optimum dose to raise the junction effectiveness, the supplemental groove 18 is formed also in the central part pinched by the slot 17.

[0014] Thus, in order to join a lid 13 to the top face of an insulating substrate 15, it becomes possible to make remarkably thin thickness of the insulating substrate 15 which was required in order to insert in a lid on the side face of an insulating substrate conventionally in the range which can obtain a required mechanical strength. and in order to work in the above-mentioned example on the top face of an insulating substrate 15 compared with the case where an activity is needed to the side face of an insulating substrate 15 like before, the yield of the routing of soldering is boiled markedly and improves.

[0015] Moreover, conventionally, since he is trying to join to the side face of an insulating substrate 15 and the lid and the connection electrode formed in the wall surface of notching are soldered, it will depend on the bond strength of the copper foil adhering to the wall surface of notching, and only low reinforcement is obtained. For example, when the force which presses a lid from a top by the inattention on handling acts, the excessive force joins the solder part of a side face, and accident from which copper foil peels and a lid is omitted is caused.

[0016] On the other hand, by joining the direct lid 13 to electric conduction pattern 12a formed in the top face of an insulating substrate 15 electrically mechanically strongly, the above accident can be prevented and the reliability of a joint improves.

[0017] In addition, if electric conduction pattern 12a joined to the metal lid 13 is pulled out to connection electrode 20a linked to the ground electrode 22 formed in the rear face of an insulating substrate 15, the greater part of whole case is made into ground potential, and it becomes the so-called case ground, and is desirable also from the top of the cure against an electromagnetic wave.

[0018] Moreover, although soldered to a part for the joint of an insulating substrate and a lid by giving the solder of optimum dose by the above-mentioned explanation, even if it uses electroconductive glue etc., of course, the same effectiveness is acquired.

[0019]

[Effect of the Invention] As explained in full detail above, according to this invention, the height which meets the request of small and thin-shape-izing of electronic equipment can offer the quartz resonator of a low surface mount mold with the small volume. And since an easy and positive activity can be performed with the solder of optimum dose, the homogeneity of a product improves and it is useful to raising dependability.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the perspective view explaining the gestalt of operation of this invention of the crystal oscillator of a surface mount mold.

[Drawing 2] It is the insulating-substrate Fig. of the crystal oscillator of the surface mount mold explaining the gestalt of operation of this invention, and drawing (a) is a plan and drawing (b) is a bottom view.

[Drawing 3] It is the important section enlarged drawing of the crystal oscillator of the surface mount mold explaining the gestalt of operation of this invention.

[Drawing 4] It is the assembly perspective view of the crystal oscillator of the conventional surface mount mold.

[Drawing 5] It is a perspective view in the condition that the crystal oscillator of the conventional surface mount mold was completed.

[Description of Notations]

1, 15 ground electrode, 2 An insulating substrate, 13 A lid, 3 Electronic parts, 4 6 A through tube, 5, 19 notching, 20 7 A connection electrode, 16 The extension section, 8 A joint, 9 The bulge section, 10 11 A crevice, 21 Solder, 12 An electric conduction pattern, 14 A mounting electrode, 17 A slot, 18 The supplemental groove, 22

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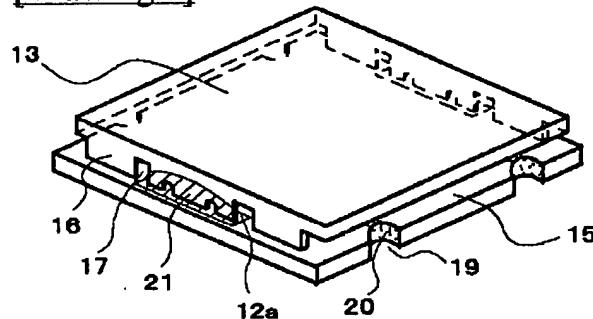
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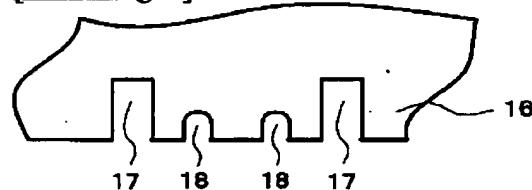
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DRAWINGS

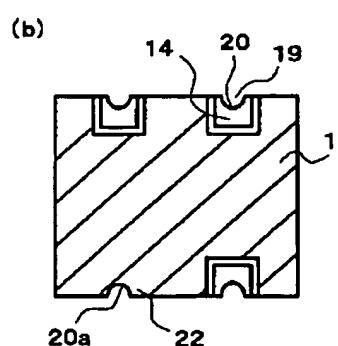
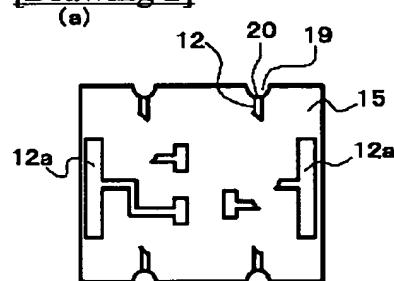
[Drawing 1]



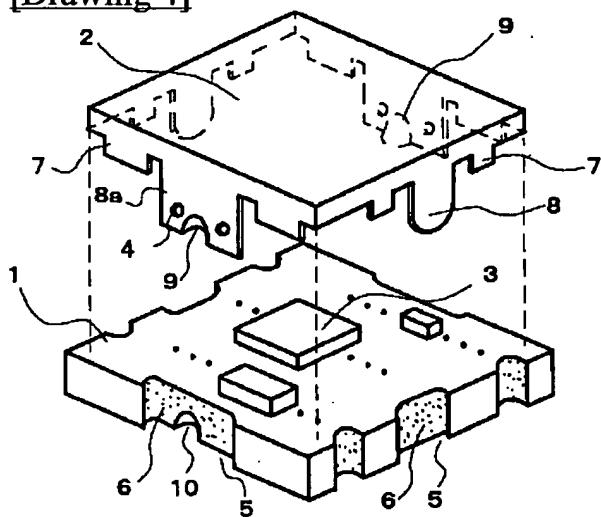
[Drawing 3]



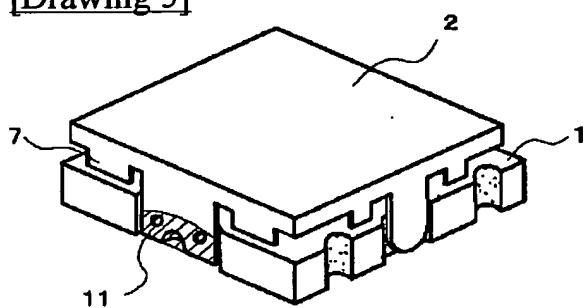
[Drawing 2]



[Drawing 4]



[Drawing 5]



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